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Down Syndrome and Referential Communication: Understanding and Production

Agata Maltese*, Gaetano Rappo^a, Lidia Scifo^a, Annamaria Pepi^a*^aDepartment of Psychology, University of Palermo, V.le delle Scienze Edificio 15, 90135, Palermo, Italy*

Abstract

This study aimed to evaluate the ability of referential communication in subjects with Down Syndrome (DS). We evaluated the possibility that the referential communication is the result of a set of cognitive factors, verbal and nonverbal through the evaluation of relationship between cognitive abilities in individuals with DS and typically developing. In particular, we have identified some critical dimensions of communicative function, such as the referential communication, which means the subject's ability to produce or the listener or messages "referentially oriented", ie messages that are characterized by "clarity or ambiguity referential". The referential communication skills, intended both as production (speaker condition) and as understanding (listener condition). Furthermore, has been decided to deepen their understanding through a test that assesses understanding of the text. This choice stems from the need to investigate whether the understanding of a text for individuals with DS could be easier than the understanding of individual messages. It is assumed in fact, that understanding of a text works as a facilitator in coherent mental representation of the text, compared to a single message.

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* Corresponding author. Tel.:0039- 09123897727 ; fax: 0039- 0916513825; *E-mail address:* agata.maltese@unipa.it

1. Introduction

Children with DS have a global delay that affects motor development, cognitive, communicative and language. In developing communication and language, they provide lower performance than chronological age (Annaz, 2009). The communication profile DS children is different from that of children with autism and typically developing. In fact, children with DS, presenting a specific disorder in the production of words, but they have a rich production of the communicative gestures, that is deictic referential. The deictic gestures, especially the state, are made very frequently, showing that the communication of these children is closely linked to the context within which it operates and exchange related to the here and now. An essential aspect of DS is that there is no difficulty in attention and shared triadic interaction: they are able to alternate gaze between the adult and a moving object, also look at the adult social games, the same way as typically developing children. In contrast to children with autism, children have greater ease in using the DS indicate intention declarative rather than intention, as well as difficulties in performing the required behavior of an object or request for help about an object. Different to autism and normal development is the use of referential gestures, children with DS are able to use different referential gestures such as "hello", "no" and "clapping" and produce them very frequently (Cain & Oakhill, 2007). Children with DS use referential gestures more often than typically developing children, which means that in these children's symbolic capacity behind the vocal production at least in part depends on the extent of mental retardation, attention deficit, which could be linked to memory problems and processes acoustic, phonological, and articulatory (Lemons, 2010).

Another feature of the communicative profile of these children is the relationship between gestural and vocal repertoire. Children with DS start using gestures and words in a manner similar to children with typical development, and then sign their production continues to grow and is more sophisticated than that of typically developing children. In particular, for what concerns the gesture of indication, the DS children are able to use more easily such a gesture both in the interactions with the mother with a peer (Laws, 2004).

Children with DS have some anatomical differences (high-arched palate, lengthening of the mandible forward, narrowing of the buccal cavity, flattening of the angles of the jaw, muscle hypotonia articulators) that may make it difficult, at first, the articulation of different phonemes. As for the production of the first words DS children show at least one year of delay in respect of typically developing children (Jarrold, 2009).

Down syndrome is the most common biological cause of intellectual disability. Children with Down syndrome are, like other children with learning difficulties, at risk for impaired language development (Chapman & Hesketh, 2000). Their ability varies widely; though the majority shows moderate learning difficulties (Chapman & Hesketh, 2000; Pueschel, 1994; Roizen, 2002) some have severe learning difficulties while other individuals have close to average intellectual ability (Pueschel, 1994; Roizen, 2002). This large variation makes it difficult to identify a universal or typical language profile for this group of children.

The language development of children with DS usually has a delay that is manifested by a lack of words, which is somewhat offset by a rich production of communicative gestures, both deictic and referential. There are periods of mental development (7 - 12 months), in which language and communication can be equal to the mental age, while with a mental age of 17 months, compared to the control group, this children show a significantly lower level in vocal production and a higher level in the production gestural.

The deficiency presenting children with DS is therefore specific of voice production, independent, at least in part, by the extent of delay, deficiency that could be linked to problems in the memory and processes acoustic, phonological and articulators. With regard to the development of verbal language, it should be noted that the development of the phonological and vocabulary are slow in mental retardation, although the stages of these developments are proceeding in the same sequential order as that of other children.

1.1 Communication in Typical Development

Communication for transfer information between people is fundamental to human society. Effective communication facilitates social relationships and community living. We communicate in many ways, including using speech, facial expression, body language and signs. Spoken communication is, however, highly valued in our society. The Listener's Role By age 8 or 9 years, Typical Development children evidence near adult-level competence in the listener's role in referential communication tasks (Cain & Oakhill, 2007). Younger Typical Development children, however, have considerable difficulty communicating adequately during these tasks. Found that children aged 5 and 6 years did not consistently evaluate utterances for adequacy and therefore were not able to discriminate between ambiguous and informative utterances. In fact, found that 5-and 6-year-olds were not able to tell the difference between what a speaker said literally and what the speaker meant to communicate. She suggested that children do not notice ambiguity within an utterance because they do not evaluate independently the literal meaning

of the utterance and what they believe to be the speaker's intended meaning. Consistent with Beal's suggestion, if the possibility of ambiguity is pointed out explicitly, the performance of Typical Development children this age improves considerably. For example, showed that 5- and 6-year-old Typical Development children were able to differentiate between ambiguous and informative utterances provided by the speaker if the children were warned that the speaker might try to trick them (Maltese, 2012). Difficulties verbalizing message inadequacy during conversations are likely to create problems in social interactions (Abbeduto, 2008). The listener is responsible for monitoring his or her comprehension of what the speaker has said, identifying any problems with the speaker's message, and if necessary formulating a response indicating that a problem was encountered and the specific nature of the problem. These skills are critical for successful social communication, as conversations typically build on information previously provided (Jarrold, 2009).

1.2 Communication in Down Syndrome

Children with DS have a global delay that affects motor development, cognitive, communicative and language. The incorrect expression of genes on chromosome 21 causes a series of neurophysiological alterations in the development, somatic, motor, cognitive and language that may vary considerably from individual to individual. From the literature shows that these subjects follow the same general language acquisition of children with typical development, although their language left behind compared to their non-verbal cognitive skills and then proceed with a slower pace. Language development is severely compromised in DS (Lemons, 2010).

An interesting question concerns the possibility to follow, albeit in a delayed, the same acquisitional sequences typical of normal development (hypothesis of delay), or if, in addition to being very slow to follow trajectories also abnormal, atypical compared to those for the normal (hypothesis of atypical).

Children with DS often experience language learning difficulties disproportionate to their mental age. Expressive language, especially, is delayed relative to cognitively matched control children (Chapman, 1995), often resulting in wide expressive–receptive and expressive–cognitive gaps. According to Miller (1992), a majority of children in the early word learning period already exhibit productive vocabulary deficits, and the number with detectable gaps increases with age. In contrast, receptive deficits are often not detectable until later, relative to measures of mental age (Chapman, Schwartz, & Kay-Raining Bird, 1991). Consequently, children with DS often seem to have things to say, but reduced means with which to say them. This observation has led many practitioners to introduce sign language as an alternative mode of communication for children with DS when they are first beginning to talk. One estimate places the frequency of such an intervention as high as 85% (Miller, 1992). In early periods of language development, the size of the expressive lexicons of children with DS (estimated from parent report on vocabulary check lists) are typically smaller than that of matched, typically developing control children (Miller, 1992). The discrepancy between the size of the expressive lexicons in children with DS and that of MA-matched peers can be reduced if both spoken and signed word contributions are taken into account (Chapman, 1995).

Thus sign use can augment the expressive lexicons of at least some children with DS. Children with DS experience many constraints as they develop, learn and use the spoken language of their communities. Some constraints are congenital and linked to the extra genetic material; others emerge developmentally as children adapt to their physical, social and linguistic environments. Some will overcome these constraints to become good communicators, but many will experience difficulties in using speech to communicate effectively with others. Children with DS present with more speech and language impairments than their typically developing peers, but impairments specific to the syndrome have yet to be identified. The range of communication impairments is similar to that encountered in the general pediatric population. Some may experience difficulties with the content (semantics) or the form (grammar, phonology) of the language, or with its use in interpersonal communication (pragmatics). Difficulties may also arise with speech intelligibility, voice and fluency (Cain & Oakhill, 2007).

In the present study, we consider an area of pragmatics that has not yet been examined for individuals with DS: referential communication. This is the type of communication that occurs in situations where the speaker's goal is to convey information that will enable a listener to identify a referent from confusable alternatives, and the listener's goal is to correctly identify the referent or to tell the speaker that the referent cannot be identified and explain why. Within this type of task, the listener is responsible for monitoring his or her comprehension of what the speaker has said, identifying any problems with the speaker's message, and if necessary formulating a response indicating that a problem was encountered which includes information regarding the nature of the problem encountered. These skills are critical for successful social communication, as conversations typically build on information previously provided (Levorato, 2007).

The literature on language development of children with DS showed their difficulty in using the more complex parts of speech in both production and comprehension of messages.

2. Objectives

Based on these theoretical considerations, we investigated the "referential communication" is defined as the basic function of communication, consisting of the exchange of information between the interlocutors on a subject or "referent". In particular, has been verified relationships between cognitive abilities and referential communication in children with DS and typically developing. In addition, we analyzed in children with DS: the relationship between the condition speaker and listener of referential communication and the difference between the understanding of a single message and text.

3. Method

3.1. Participants

A total of 12 children participated in the present study: six children with DS and six typically developing children. The criteria for inclusion in the typically developing children group were a mean chronological age nearly equivalent to the children with DS. The mean chronological age of the children with DS was (7 years and 8 months) and the mean chronological age of the children with typically developing was (8 years and 1 month).

3.2. Materials and procedure

The tests were administered to 12 subjects individually in different phases, in a specially constructed to avoid any distractors.

Assessment of cognitive abilities

In the first phase is administered to all subjects (six children with DS and six typically developing children) a test that evaluates non-verbal skills, the CPM (CPM Coloured Progressive Matrices), (Raven, 1996) which consists of 36 items in 3 sets (A, Ab, B), with 12 items per set. Each item requires individuals to select, from a choice of six options, the image that correctly completes a central pattern. Participants determine the correct match on either a perceptual basis (early items on the test) or a conceptual basis (later items). Performance was measured in terms of the total number of items correctly identified.

Before the ability to reason by analogy has developed, or in cases where intellectual ability has become impaired, in fact, the CPM can be used to assess the degree to which children with DS can think clearly, or the level to which their intellectual abilities have deteriorated.

The three sets of 12 items are arranged to assess the chief cognitive processes of which children under 11 years of age are usually capable. The CPM items are arranged to assess cognitive development up to the stage when a person is sufficiently able to reason by analogy and adopt this way of thinking as a consistent method of inference. As verified in this study, this stage in intellectual maturation appears to be one of the earliest to decline as the result of organic dysfunction.

Assessment of Referential Communication

In the next step at a later time is evaluated the Referential Communication was used PCR (Referential Communication test), (Camaioni, Ercolani, & Lloyd, 1995) that intended for persons in childhood, extent, in the same test, the child's ability to produce fully informative messages when he speaks and his ability to understand the messages he hears, whether appropriate or inappropriate. The originality of this instrument, compared to other already existing, is to allow assessment of the ability of the child to relate the message, meaning and referent. The test that evaluates the referential communication measures two dimensions: "the speaker condition" and "the listener condition". For referential communication means, the ability to verbally refer to an object or event outside, so as to identify them and the alternatives and implies the ability to formulate their messages as clearly as possible and also the ability to recognize when received messages are not clear and need to request additional information (Camaioni, 1995). The test consists in the presentation of a set of tables, with increasing difficulty, which differ in different size-based criteria: shape, color, size, quantity, spatial relation, status change.

Assessment of Understanding the text

To better study the dynamic processes underlying the comprehension of informational messages, it was decided to administer a test to two groups of understanding TOR (Oral Comprehension Test), (Levorato & Roch, 2007), which is standardized on 1700 Italian children aged between 3 and 8 years (Levorato & Roch 2007), and it measures listening text comprehension without involving language-production skills. The choice of this instrument is the need to investigate whether the understanding of children with DS is easier for individual messages or text (stories).

The test is similar to the reading comprehension test in terms of story structure, types of questions (that is, literal and inferential) and type of task (that is, multiple choice), and it was chosen in order to have a parallel measure of listening and reading comprehension, as suggested by previous studies (Hoover and Gough 1990, de Jong and van der Leij 2002).

The standardized tests, such as those used in this study have obvious limitations in the assessment of language skills, since the criteria for administration are rigid and make little motivation and fluctuating attention and, above all, do not get large enough samples of spontaneous speech can be representative of the actual language and communication skills of individuals. Only a more complex analysis that takes into account all aspects of language processing may allow you to simultaneously evaluate the operation of different cognitive processes such as language skills of the subject, his ability to access the storage memory, and attentional resources to their to understand and describe the emotional aspects..

4. Results

The productions of children with DS have been compared with those of typically developing children using a non-parametric test for independent samples (Mann–Whitney), given the limited number of participants in each group. Since many pair wise comparisons were performed Holm's (1979) step-down procedure was applied to correct for the probability of Type I errors

Relationship between cognitive abilities (CPM) in Typical Development and Down Syndrome

It was therefore verified the relationship between cognitive processes of relational the abstract type, which were as much as possible independent of content knowledge and fluid intelligence and crystallized both typically developing children than in those with DS. The Mann–Whitney non-parametric U-test for independent samples reveal any significant differences of the two groups (six children with DS and six typically developing children) to the test CPM ($U = 54.00$; $p > 0.05$). In essence the findings of this report the ability to capture correspondences, analogies logical implications of the typical tests that assess cognitive abilities such as CPM, including visual-spatial stimuli is involved and influence the Referential Communication. This competence requires, in fact, skill-composition and decomposition of tasks, of a text. It thus shows the importance of the cognitive component, in both verbal and nonverbal aspects of Referential Communication.

Relationship between “speaker condition” and “listener condition” in Referential Communication

In the test that evaluates the Referential Communication therefore the “speaker condition” has been correlated with the “listener condition” to verify the existence of a dissociation between production and comprehension in children with DS.

As shown a correlational non-parametric analysis (Spearman's Rho) underlined that a positive, highly significant correlation emerged between the “speaker condition” during the observation session and the total number of “listener condition” considering both the group of children with DS ($\text{Rho} = 0.856$; $p < 0.001$) and the group of typically developing children ($\text{Rho} = 0.884$; $p < 0.001$). There are correlation between the status of speaker and listener condition. The referential communication skills, intended as production (speaker condition) correlated significantly with the communication skills understanding referential understanding (listener condition). This correlation is applicable to all patients with SD both those with typical development.

A particularly interesting concerns the discrepancy between the performance test production (65% in DS and in 71% typically developing) and understanding (35% in DS and 29% in typical development), as shown in **Figure 1**. In fact, in both groups to test the performance of both understanding of ambiguous messages that information is lower than the ability to produce messages "Referentially oriented"

So, in the condition of "listener condition" especially children with DS have the weakest performance of the "speaker condition", this can be explained by cognitive rigidity typical of SD, that will not allow such persons to use their repertoire of knowledge and information that allows the activation of those operations that are necessary for inferential "disambiguate" message. The typically developing children choose to ask more questions to resolve the inconsistency in the message."

Exposure to more complex linguistic stimuli allows the child to expand their vocabulary, produce and understand messages more informative following morphosyntactic rules increasingly sophisticated. Messages produced by children with Down syndrome, are characterized as redundant, short, little developed in terms of syntactic and pragmatic. In contrast, subjects with typical development are better able to produce and understand informational messages that allow the other party to grasp immediately the reference target.

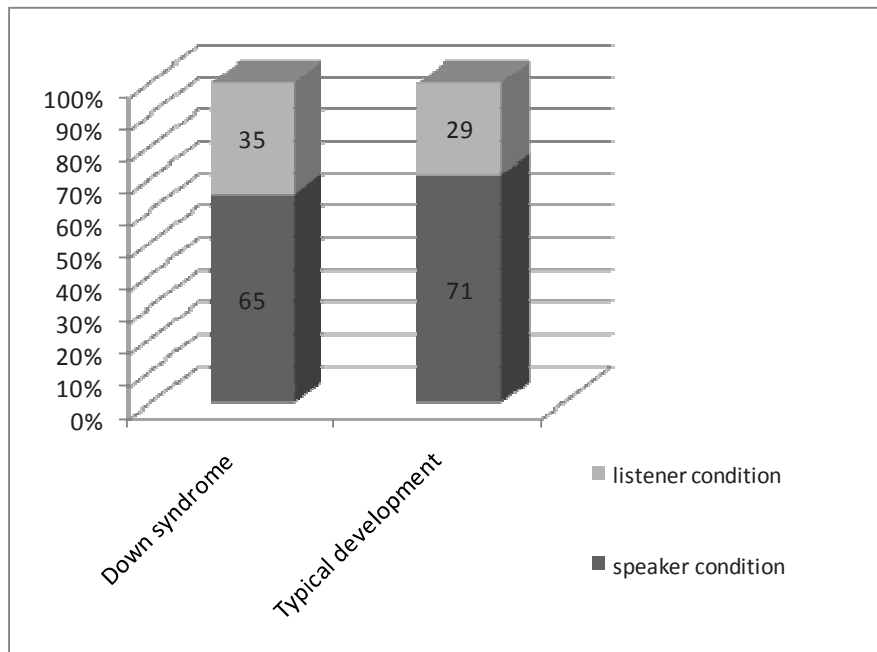


Figure 1. test results of Referential Communication to the speaker condition and listener condition, in children with DS and Typical Development

It was subsequently administered the TOR to deepen listener condition of PCR. The results of the tests of the TOR by the subjects with DS confirm the presence of difficulties in deriving inferences based on information in the text. Children with DS, in fact, have correctly answered the most questions of a text that explicitly provide for the recovery of information contained in the text and made errors in answering questions that require the ability to derive inferences. These results suggest important directions for planning activities enhancement the understanding of the spoken text. In fact, according to our hypothesis, the results of the TOR (understanding of the song) are better than the performance of PCR to understanding (comprehension of the message). This might be explained in terms of exhibition structure of text that can facilitatare the mental representation of the text.

We also conducted a correlation between the two tests (TOR and PCR), This difference is statistically significant on the Mann–Whitney U-test ($U = 14.00$; $p < 0.05$), those which perform well in PCR to improve also the TOR. This significance strengthen the hypothesis that texts constructed according causal cohesion facilitates the use of memory and can be used in the empowerment programs in the development typical atypical. The two groups produced a similar proportion of text comprehension ($U = 51.00$; $p > 0.05$): on average 28% ($SD = 28.83$; range = 0–100) in the children with DS and 32% ($SD = 14.84$; range = 16–71) in the control group.

5. Discussion

Individuals with DS does not have a profile static but dynamic. It 'necessary to adopt an ecological complex and systemic approach that takes into account the peculiarities of the profiles of subjects with DS. It 'need to use more complex tools that take into account the dynamic factors underlying the understanding and production of messages that explain the specificity of language and communication profiles in subjects with DS. Even though the small number of participants is a limitation of the study, the results provide some useful indications for the planning of intervention programmes on language development in children with DS (Annaz, 2009).

Despite increased sociability and relative strengths in concrete vocabulary and the structural aspects of language, children with DS do not reliably indicate to their conversational partner when a message is inadequate. Even when they do indicate message inadequacy, children with DS often do not indicate the specific problem and in some cases even identify the wrong . These findings provide further evidence of a pragmatic impairment in DS. These pragmatic problems are related to difficulty understanding false belief. It is likely that the difficulty that children with DS have in referential communication and more specifically, verbalizing message inadequacy contributes to the frustrations they and their communicative partners frequently encounter during social interactions. Understanding referential communication impairments is a crucial step toward the development of interventions to address the social communication weaknesses of children with DS.

Constraints on perception, discrimination and categorization reduce opportunities to learn about the world and to code this knowledge into abstract semantic units for the content of language. They also reduce opportunities to identify and learn the community rules of language form. Careful management of sensory constraints will foster development of the visual and auditory attention skills that support language (Annaz, 2009). Infants who are experiencing constraints on visual or auditory learning may benefit from an environment in which the information to be learned is amplified, clarified and repeated, and where spoken language is accompanied by the use of gestures or visual symbols. Infants with DS have been found to have visual preference in learning, which has been utilized in the development of specific reading and signing programmes to provide a route to early language. These may not be appropriate for all as some may foster a reliance on a gestalt approach to learning, at a cost to the analytic system needed for referential language. Infants need to hear and listen to the spoken language of their communities in order to develop knowledge of the rules of the language system. They also need to adopt and adapt the sounds and rules to their developing physical capabilities. Infants with low muscle tone may experience constraints in developing the cross-modal imitation skills that facilitate babble and early word patterns. Sharing knowledge of possible delays in the development of early imitation skills and of ways to develop purposeful imitation in daily routines with parents should provide infants with a useful learning tool (Lemons, 2010).

The persistence of direct imitation and a preferred visual learning style may contribute to the success of signing programmes based on signed spoken language with children with DS in the early language learning stage (Vicari, 2002). These children may, however, be slower to progress from gesture and proto-language to referential speech or sign language. The early use of gestures and signed speech enables the child to communicate wants, needs and feelings in context, but additional supports may be required to prompt development of the grammatical system that enables speech and sign language to be referential. Regular monitoring and the sharing of individual communication profiles with parents from the early stages of prelinguistic development should ensure that language learning is promoted during daily routines. Assessment may indicate that direct therapy is required, but indirect therapy may be more appropriate for all during early language development. Parental and career education programmes and interventions embedded in daily routines will frequently provide the necessary support to foster language development. Regular speech and language therapy reassessments during childhood can ensure that all aspects of the language system are developed and used to facilitate interpersonal communication and language for thinking. Not all children with DS will require intervention all the time, but regular monitoring allows the right therapy to be provided at the right time to promote language development (Jarrold, 2009).

Comprehension of a text, whether written or oral, is a complex ability that involves both cognitive and linguistic components, and occurs through various processes that have been defined as lower and higher level processes (Cain & Oakhill 2007). Among the lower level processes there are the recognition of word meanings and the construction

of sentence meanings through the use of morpho-syntactic knowledge. These processes are necessary but not sufficient because the linguistic information contained in the text has to be integrated into a coherent semantic representation through inferential processes and the use of previously acquired world knowledge (Cain & Oakhill, 2001). All these processes are common to reading and listening comprehension (Cain & Oakhill 2007).

In a recent study it was demonstrated that also in DS, both lower level abilities, such as receptive vocabulary and sentence comprehension, and higher level components, such as the ability to use the context, accounted for individual differences in listening comprehension (Levorato, 2009). What has still to be established is which factors, among those that underlie text comprehension in individuals with DS, are shared by reading and listening comprehension, and which ones are, on the contrary, specific to each modality of text understanding. Speculatively, we could argue that short term and working memory may, at least in part, account for the unshared variance between listening and reading comprehension, and, therefore, be modality dependent. It is likely that in a reading comprehension task, where linguistic information is available for the time necessary to process it, short term memory plays a minor role; on the other hand, listening comprehension might rely more heavily on the ability to remember verbal information, and may be, therefore, a cause for a poorer performance in listening than in reading comprehension. Future investigation should control the effect of the modality—written versus oral—on the involvement of short term memory in text comprehension, in particular in DS individuals where short term memory represents an area of particular weakness

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